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# A LONGIROSTRINE CROCODILIAN FROM MURUA (WOODLARK), SOLOMON SEA

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## ABSTRACT

*Gavialis papuensis* de Vis, represented by fragmentary remains of a mandible, vertebrae and dermal scutes, is not attributable to the genus *Gavialis*. The laterally directed mandibular alveolae, with projecting alveolar collars, suggest comparison with *Charactosuchus*, *Euthecodon* and *Ikanogavialis*. Similarity is greatest to the latter taxon. The specimen is too incomplete for confident definition, is probably of Pleistocene age and comes from Busai, Murua Island, in the Solomon Sea.

## INTRODUCTION

De Vis (1905) described fragmentary crocodilian remains from Murua (Woodlark) Island, situated east of Papua New Guinea and ESE of the Trobriand Islands in the Solomon Sea (Fig. 1). He referred these remains to a new species, *Gavialis papuensis*, to my knowledge never again cited in the literature. The remains were attributed to a single individual and comprise two segments of the symphyseal region of the mandible with a single, incomplete tooth crown, now separated (QM F406), two cervical, one dorsal, one sacral and two caudal vertebrae (all


FIG. 1. World map showing localities of *Euthecodon* and crocodilians of similar habitus. A, *Charactosuchus kugleri*, Jamaica; B, *Ikanogavialis gameroi*, Venezuela; C, *C. fieldsi*, Columbia; D, *Euthecodon arambourgi*, Libya; E, *E. nitriae*, Egypt (Wadi Natron) and *E.* sp. Egypt (Moghara); F, *E. brumpti*, Ethiopia; G, *E.* sp., Kenya; and, H, the Murua crocodilian, Murua.

numbered QM F340), and one complete and one incomplete dorsal scute (both numbered QM F341).

The material is clearly not attributable to the genus *Gavialis* as it shows laterally projecting teeth and alveolar collars not found in that genus. These features are also found in *Charactosuchus*, *Euthecodon* and *Ikanogavialis*, all of which are found far from the Solomon Sea (Fig. 1). The absence of other narrow-snouted crocodilians from the New Guinea area makes it desirable to retrieve this material from obscurity (*Crocodylus novae-guineae*, although often described as narrow-snouted, is not really comparable to such forms as *Gavialis*, the dyrosaurs, or de Vis' material). This material is of further interest as it represents another occurrence of an unusual crocodilian habitus, probably later in date than most similar forms, and is the first to include posteranial material.

The abbreviation QM refers to the Queensland Museum.

## LOCALITY AND STRATIGRAPHY

The fossils were collected from a mullock heap at Busai (de Vis, 1905). Trail (1967) shows Busai on Coleman's Ck., at the head of the Muniai River (Fig. 2). Three rock types are present at Busai: Tertiary intrusives, Okiduse Volcanics (Miocene), and Quaternary sediments. The fossils did not derive from the intrusives, but may have come from either of the other two units. The Okiduse Volcanics in this region consist of tuff, lava and agglomerate, and the Quaternary sediments include coralline limestone, clay, conglomerate and alluvium (Trail, 1967).

De Vis gives no information regarding the matrix found with the fossils, but a fine-grained bluish-grey matrix was present on one of the vertebrae. This matrix consisted largely of fragments of coralline limestone with a few quartz grains, so that the crocodilian remains likely derive from the Quaternary sediments.

## DESCRIPTION

MANDIBLE. The two mandibular segments (Pl. 1) show no trace of the symphysis. There is no clear sign of contact between the two segments. One segment is preserved as a single piece, on one side (assumed to be dorsal) very slightly concave transversely, and on the other convex. Both surfaces bear short, shallow, narrow, longitudinal grooves, which are much more abundant on the convex surface. The alveoli face laterally and slightly dorsally, so that the long axis of each alveolus, projected into the transverse plane makes an angle of about 15 degrees with the horizontal. Most are empty, although roots or portions thereof are present in five. Where well-preserved the edges of the alveoli extend outward as low collars

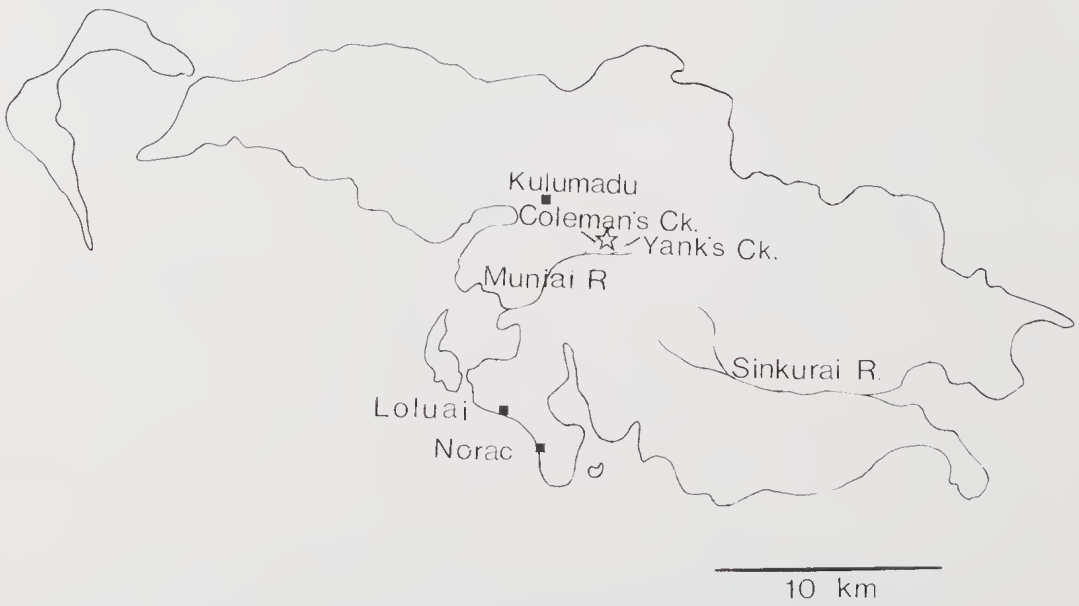


FIG. 2. Map of Murua (after Trail, 1967). Busai is represented by the star: the Murua crocodilian, *Chelone murua* and *Halicore brevirostre* were found in mine tailings in this area.

surrounding the aperture. Nowhere are these collars completely preserved. This segment bears remnants of eight alveoli per side.

The second segment is in two pieces, broken in the horizontal plane, but is otherwise much like the first. The pieces are less well-preserved showing much wear and some breakage. No alveolar collars are preserved, but the segment is so worn that none could be expected. No teeth are present, but each side of the segment bears evidence of eight alveoli. If both segments derive from the same individual, then it had at least fifteen alveoli on each side of the symphseal portion of the mandible.

Tooth. A single, small, incomplete crown (Pl. 2, Figs. 6, 7) not mentioned by de Vis was found in the same specimen box as the mandibular segments and is thus assumed to pertain to this form. The crown is thin and recurved and fits none of the roots still in place. It bears distinct carinae, presumably anteriorly and posteriorly, and its surface is longitudinally striate.

Cervicals. Two cervicals (Pl. 2,c), possibly successive, are preserved. Both are markedly procoelous with small, anteriorly placed hypapophyses. The neural arch is badly worn and lacks all processes on one and is missing from the other.

The parapophyses are low on the anterior half of the centrum, and the neural canal is roughly triangular in transverse section. In other features these cervicals are much like those of modern crocodilians.

Dorsal. A single dorsal (Pl. 2,d) resembles those of the existing Australian crocodilians, but with the anterior central face inclined at about 30 degrees to the long axis of the centrum. Of the neural arch only the left prezygapophysis remains, with the facet inclined at about 45 degrees to the horizontal.

Sacral. The single sacral (Pl. 2,s) in addition to the centrum retains most of the arch but is lacking the postzygapophyses and the top of the neural spine. Both transverse processes are broken. The concave anterior central face is broad, and the convex posterior face is subtriangular in form with the apex ventral. The posterior face is set somewhat ventral to the anterior (as it is also on the dorsal centrum). The neural canal is subtriangular in section, and the prezygapophyseal facets are inclined to the horizontal at about 50 degrees. There are distinct sulci both anteriorly and posteriorly on the sacral ribs.

Caudals. One caudal (Pl. 2,k) lacking most of the arch, has a double keel ventrally terminating both anteriorly and posteriorly in facets for the chevrons. The posterior central face is set lower than the anterior, but not by as great a degree as in the dorsal and sacral. The second centrum (Pl. 2,k) with the arch disarticulated is unusual and may not be a caudal. The concave lateral and ventral surfaces of the centrum meet in a long process, now broken. Such processes are not found on any of the other crocodilian material available to me for reference, and do not have the appearance of pathological features.

Scutes. The osteoscutes (Pl. 2, Figs. 4, 5; de Vis, 1905, pl. 13) need no detailed description. Both scutes are bevelled along one margin, and bear a sutural articular surface along an adjacent margin (Pl. 2, Fig. 4)

Comparison.

The long, narrow symphyseal region restricts comparison to longirostrine forms, and in view of the recent date only Cenozoic forms will be considered. These include: *Charactosuchus*, *Crocodylus (cataphractus* and *johnsoni)*, *Dollosuchus*, *Dyrosaurus*, *Eosuchus*, *Euthecodon*, *Gavialis*, *Gavialosuchus*, *Hesperogavialis*, *Hyposaurus*, *Ikanogavialis*, *Phosphatosaurus*, *Rhabdognathus*, *Rhamphostomopsis*, *Rhamphosuchus*, *Tilemsisuchus* and *Tomistoma*. Of these, most have the mandibular alveoli orientated vertically unlike the Murua form: this leaves only *Charactosuchus*, *Ikanogavialis* and *Euthecodon* for close comparison (Fig. 3).

*Charactosuchus* is represented by *C. fieldsi* (Langston, 1965) from the late Miocene of Colombia and *C. kugleri* (Berg, 1969) from the Eocene of Jamaica, and *Ikanogavialis* (Sill, 1970) by the single species *I. gameroi* from the late Miocene (Bocquentin Villanueva & Buffetaut, 1981) of Venezuela. *Euthecodon* is represented by three species. The earliest and least developed is *E. arambourgi* (Ginsburg and Buffetaut, 1978) from the Burdigalian of Libya and Egypt. *E. nitriae* (Fourtau, 1920) ranges from the Burdigalian to the Villafranchian in Egypt (Ginsburg & Buffetaut, 1978), and the most extreme, *E. brumpti* (Joleaud, 1920) comes from the Villafranchian of Ethiopia. *Euthecodon* sp. has also been found in the early Miocene of Kenya (Buffetaut, 1979; Ginsburg & Buffetaut, 1978; Tchernov & Van Couvering, 1978) and the Pleistocene of Ethiopia (Arambourg, 1948). Murua is over 10,000 km from Ethiopia and farther from the other mentioned localities, and if

the stratigraphy of the Murua deposits is correctly interpreted, the Murua crocodilian is younger than *C. kugleri, C. fieldsi, I. gameroi* and *E. arambourgi,* and quite possibly younger than *E. nitriae* and *E. brumpti* as well.

Little or no mandibular material has been figured for either *E. nitriae* or *E. arambourgi* so comparison cannot be made. The relatively broad (for a *Euthecodon*), tapered snout of *E. arambourgi* (Fig. 3) suggests that the mandibles might also have been tapered and hence unlike those from Murua which show no evidence of taper. The Murua mandibular pieces show no symphyseal suture unlike the figured specimens of most other forms. The figured material of *E. brumpti* (Arambourg, 1947) however shows little indication of the symphyseal suture. All of the *Euthecodon* mandibles (especially those from the Miocene) appear to differ from that of the Murua crocodilian by their longer alveolar collars. Since all of the collars of the Murua material are both broken and worn some doubt must remain about this distinction.

If the *G. papuenis* mandibular fragments pertain to a single individual it would have at least fifteen alveoli per side. *C. fieldsi* has only ten per side along the symphyseal rostrum and *C. kugleri* nine, while *E. brumpti* and *I. gameroi* both have more than fifteen alveoli per side and thus more closely approach *G. papuensis.* A further point of similarity with *I. gameroi* lies in the proportions of the mandibular pieces.

These longirostrine crocodilians with alveolar collars may be divided into two groups on the ratio of the breadth of the symphyseal portion of the mandibles (taken between the alveolar collars) to the average alveolar diameter. In both *Charactosuchus* and *Euthecodon* (except *E. arambourgi* which has a tapered snout) this ratio is approximately two, while in *G. papuensis* and *I. gameroi* it is approximately three. This ratio provides a measure of the apparent width of the symphyseal portion of the mandibles.

Arambourg (1947, pl. 35, fig. 5) figured a single crown of *E. brumpti,* which while generally similar to that of the Murua crocodilian, is broader in silhouette distally.

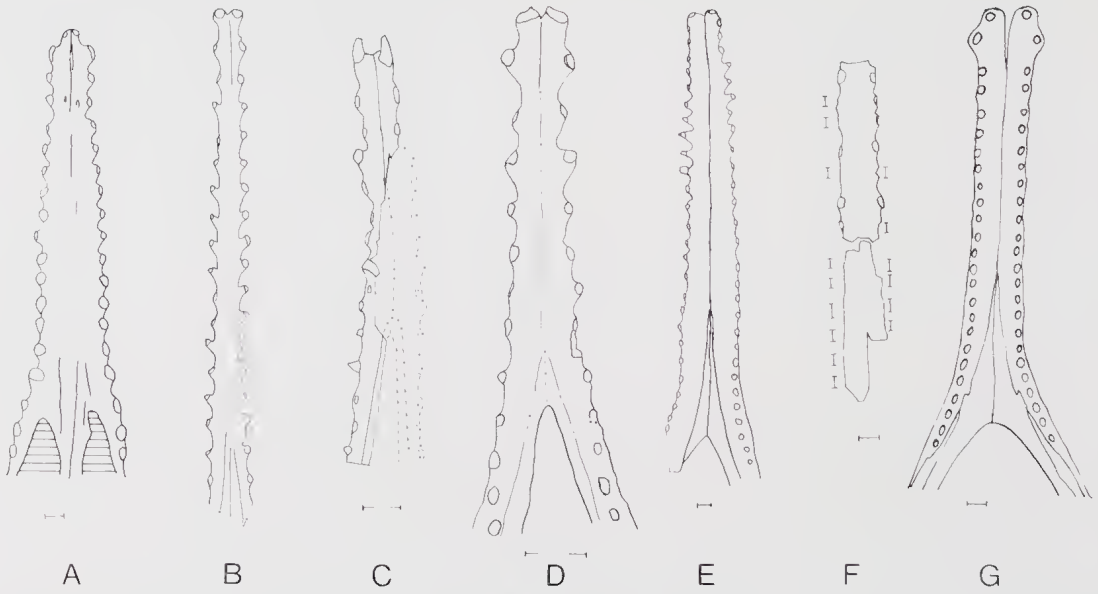


FIG. 3. Mandibular rostra (and one snout) of longirostrine crocodilians with alveolar collars. A, *Euthecodon arambourgi* (snout); B, *Euthecodon brumpti;* C, *Charactosuchus fieldsi;* D, *Charactosuchus kugleri;* E, *Ikanogavialis gameroi;* F, the Murua crocodilian, (the bracketed bars indicate alveoli not obvious in the outline); and G, *Gavialis gangeticus.* A in ventral view, all others in dorsal view, scale bars represent 2 cm, scale for B not available. The different orientation of the alveoli and absence of alveolar collars in *Gavialis* is apparent (the collars are broken on the Murua material).

## DISCUSSION

Langston (1965, p. 40) has commented that 'Longirostrine crocodilian mandibles are even more difficult to distinguish systematically than are the skulls'. Thus no firm identification is attempted here, especially in view of the incomplete nature of the Murua material, and of the absence of descriptions of postcranial material of the comparable described taxa. Because of this the postcranial material referred to *G. papuensis* does not reveal sufficiently distinctive character states to allow adequate diagnosis at this time. The mandibular material may be distinguished from *Euthecodon* and *Charactosuchus,* but not confidently from *Ikangavialis. G. papuensis* is not attributable to *Gavialis* and thus may be designated *"Gavialis" papuensis.* This is not a satisfactory designation, but pending discovery of further material it seems best to defer formal taxonomic action.

With regard to the phyletic relations of the Murua crocodilian there is only the single character state (ratio of alveolar diameter to width of mandible between alveoli) shared with *Ikanogavialis.* This may indicate a phyletic relationship with *I. gameroi,* but in the absence of supporting evidence especially regarding variability of this state this is a hypothesis not a conclusion.

Its occurence in the Solomon Sea would represent a considerable extension of range were the Murua form related to either South American forms or *Euthecodon.* In any event it shows that this particular, sawfish-like habitus was more widespread than previously believed.

The material of the Murua crocodilian was apparently found with the remains of two other vertebrates, the marine turtle *Chelone murua* and the dugong *Halicore brevirostre* (de Vis 1905). Both of these suggest a marine, or at least lagoonal environment, and suggest that the Murua crocodilian may have been a marine form. Thus the resemblance of the symphyseal region of the mandible to the rostrum of a sawfish especially in tooth orientation may reflect some similarity of environment and habits.

## ACKNOWLEDGEMENTS

Mr L. Cranfield of the Regional Mapping Section of the Mines Department, Queensland, very kindly interpreted the sample of matrix from the Murua crocodilian vertebrae. Dr E. Buffetaut supplied much needed information regarding *Euthecodon* and he and Dr W. Langston, Jr, provided considerable and useful assistance with this study.

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## NOTE ADDED IN PROOF

Fossil material from Murua was donated to the Australian Museum in 1899 (Etheridge, 1900: 7, also 24). This consisted of dorsals doubtfully attributed to *Crocodylus porosus* and vertebrae attributed to *Halicore dugong,* from 'the Gold-bearing drift': no further details were published. A recent search for this material and a relevant letter turned up only the dugong material (AM F5795), however the other specimens may yet be rediscovered. Whether this is the specimen mentioned by Stanley (1912:9) as uncovered 'In the black silt' near Busai cannot be determined. Murua is well within the range of *C. porosus* today. Mrs D. Jones and Dr A. Ritchie kindly sought the material and letter and Ms T. Lees thoughtfully drew my attention to these reports.

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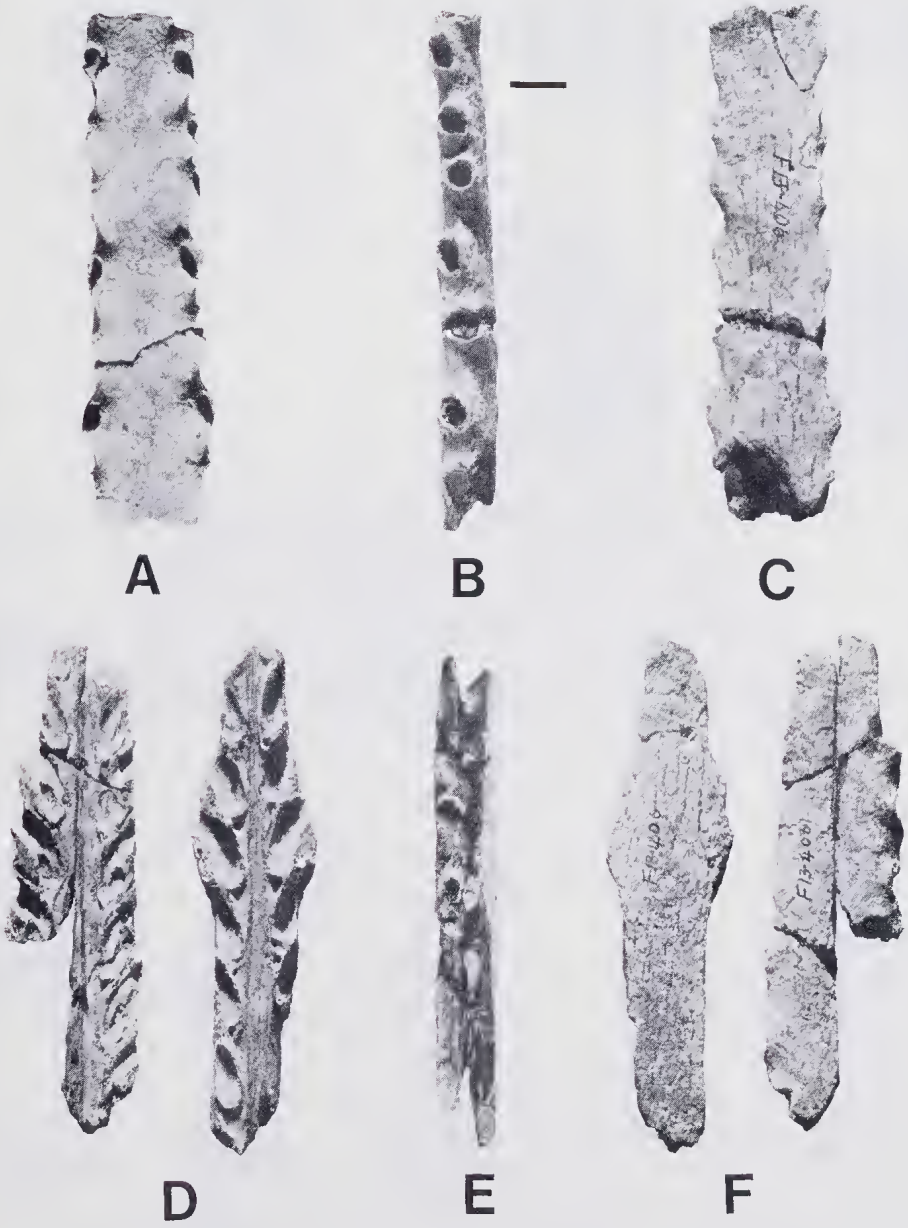
PLATE I

The two mandibular segments of the Murua crocodilian (QM F406). First segment in dorsal (A), lateral (B), and ventral (C) aspects. The two portions of the second segment in internal (D) and external (F) aspects: in the latter on the left is the presumed ventral piece and on the right the presumed dorsal. E shows the two pieces together in lateral view. Scale bar represents 2 cm.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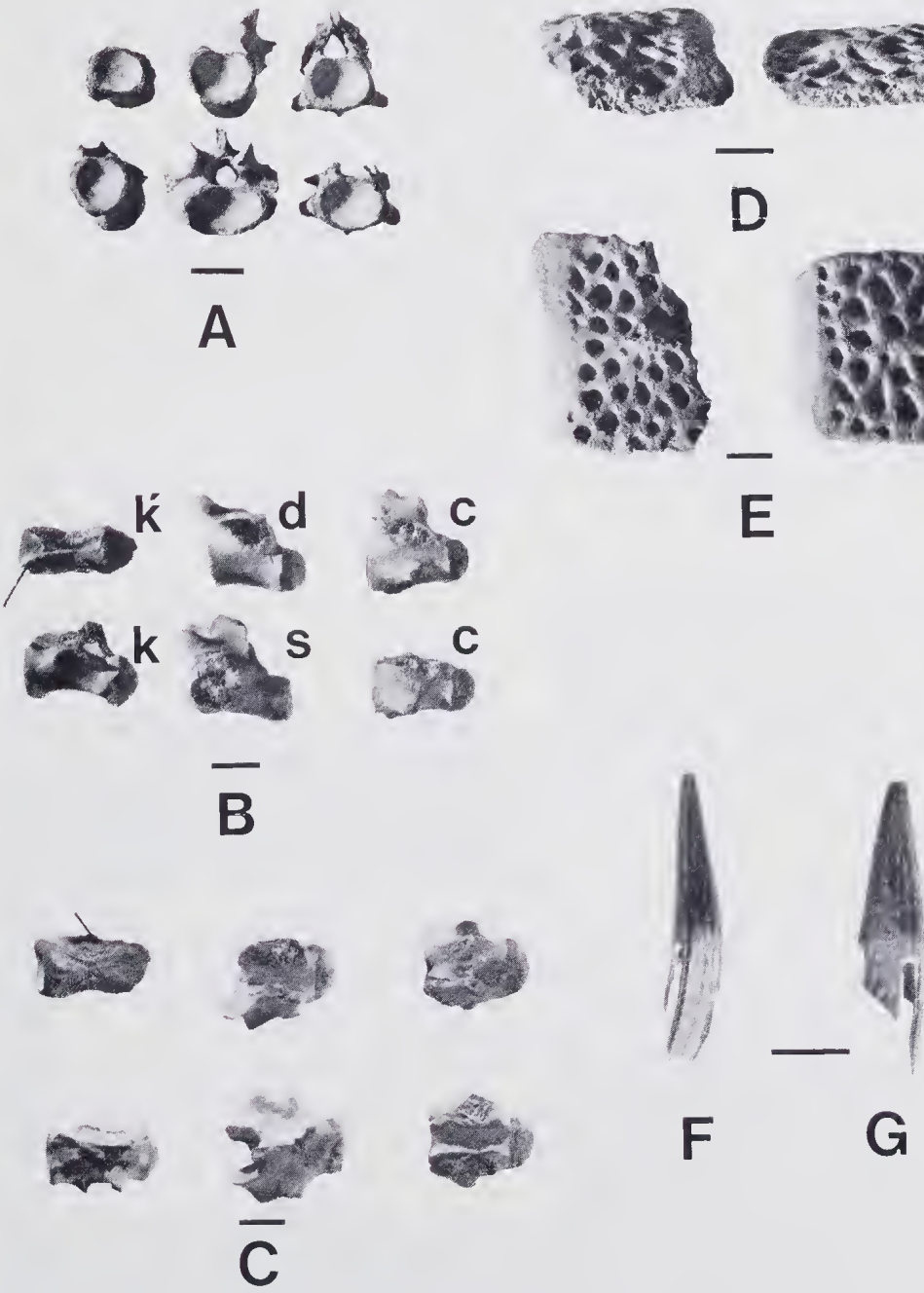
F

PLATE 2

Further material attributed to the Murua crocodilian. Vertebrae (QM F340) in anterior (A), left lateral (B), and dorsal (C) aspects. In each the scale bar represents 2 cm, and the arrangement (indicated in B) is: c, cervicals; d, dorsal; s, sacral; k, caudal, and; k', presumed caudal. The ventrolateral process of the presumed caudal, discussed in the text, is indicated by the inclined lines. Dorsal scutes (QM F341) in oblique (D) and dorsal (E) aspects. The sutural surfaces are seen in D. Scale bars represent 1 cm.

Tooth presumably associated with mandibular segments in anterior or posterior aspect (F) and medial aspect (G). Scale bar represents 0·5 cm.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